Urinary Tract Infections

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KEYWORDS

• Prevention • Catheter-associated urinary tract infection
• Health care–associated infection • Urinary catheter

KEY POINTS

- Catheter-associated urinary tract infection (CAUTI) is common and costly.
- CAUTI is often caused by hospital-based pathogens with a propensity toward antimicrobial resistance.
- Duration of urinary catheterization is the predominant risk for CAUTI; preventive measures directed at limiting placement and early removal of urinary catheters can successfully decrease catheter use and CAUTI rates.
- Intervention bundles, collaboratives, and hospital leadership engagement are powerful tools for implementing preventive measures for health care–associated infections, including CAUTI.

INTRODUCTION

Preventive measures have improved the incidence of health care–associated urinary tract infections (UTIs) in US hospitals, but the Centers for Disease Control and Prevention estimated that in 2011, a total of 93,300 catheter–associated UTIs (CAUTIs) occurred in US hospitals.[1] UTI still accounts for 12.9% of health care–associated infection (HAI) and 23% of infections in the intensive care unit (ICU).[1,2] Most UTIs are related to indwelling urinary catheters; approximately 70% of UTIs (and 95% of UTIs occurring in ICUs) develop in patients with urinary catheters.[3]

CAUTI has significant impact on clinical outcomes, including mortality, length of hospital stay, and cost.[4,5] Because 65% to 70% of these infections are estimated

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to be preventable,[6] the Centers for Medicare and Medicaid Services (CMS) no longer reimburses hospitals for the extra costs of managing a patient with hospital-acquired CAUTI.[7] In addition, CMS has required, as a condition of participation, that hospitals submit ICU level CAUTI rates to the National Healthcare Safety Network (NHSN) and CAUTI are included in hospital reporting of Healthcare Associated Conditions on the CMS Web site. Therefore, prevention of CAUTI has become a priority for most hospitals. This article reviews the epidemiology and pathogenesis, with a focus on preventing CAUTI.

PATHOGENESIS

Humans have innate defense mechanisms, such as length of urethra and micturition, that prevent attachment and migration of pathogens into the bladder; urinary catheters interfere with these natural defenses.[8,9] Biofilms, composed of clusters of microorganisms and extracellular matrix, deposit on all surfaces of urinary catheters and allow bacterial attachment.[10,11] Biofilms also provide a protective environment from immune cells and antimicrobials. In addition, microorganisms grow more slowly in biofilms, decreasing effects of many antimicrobials.[10,11] Despite slow growth, microorganisms within the biofilm may ascend the catheter to the bladder in 1 to 3 days. Typically, the biofilm is composed of one type of microorganism, although polymicrobial biofilms are possible.[10,11]

Most microorganisms causing CAUTI are endogenous organisms colonizing the patient's intestinal tract and perineum, entering the bladder by ascending the urethra from the perineum.[12] Usually (~66% of the time), organisms migrate in the biofilm on the external surface of the catheter. A smaller proportion of infections (~34%) are acquired from intraluminal contamination of the collection system from exogenous sources resulting from cross-transmission of organisms from the hands of health care personnel.[11,12] Rarely, such organisms as *Staphylococcus aureus* spread from a hematogenous source and cause upper UTI.

Although most CAUTI are caused by microorganisms from the patient's own gastrointestinal tract, approximately 15% of episodes of health care–associated bacteriuria occur in clusters from intrahospital transmission from one patient to another.[2,11] Most of these hospital-based outbreaks have been associated with improper hand hygiene by health care personnel.

EPIDEMIOLOGY OF CATHETER-ASSOCIATED URINARY TRACT INFECTION

Rates of CAUTI in US hospitals have declined significantly since 1990, because of increased emphasis on prevention.[3,13] Pooled mean rates of CAUTIs in ICUs, reported through the NHSN in 2013, ranged from 1.3 UTI/1000 catheter-days in small medical/surgical ICUs to 5.3 UTI/1000 catheter-days in neurosurgical ICUs.[14] CAUTIs in pediatric ICUs occur at a rate of 0 to 3.4 UTI/1000 catheter-days; CAUTI rates in pediatric ICUs in the United States may not be decreasing as in other ICUs.[14,15] General care wards had rates of CAUTI similar to the ICU setting, ranging from 0.2 to 3.2/1000 catheter-days; the highest rates occurred in hematology and rehabilitation wards.[14,16] In a community hospital consortium, rates of CAUTI were found to be similar in ICU and non-ICU care units, but 72% of CAUTI occurred in non-ICU patients, suggesting targeted prevention efforts for non-ICU patients may have a significant impact.[17] Rates of CAUTI reported through the International Nosocomial Infection Control Consortium 2007 to 2012, were generally higher than those reported through NHSN, with a range of 1.29 UTI/1000 catheter-days in cardiothoracic surgical ICU to 15.99 UTI/1000 catheter-days in neurologic ICUs.[18]